SK1211 User Guide

Evaluation board for Drop-In RF Transceiver Modules

GENERAL DESCRIPTION

The SK1211 is an advanced development tool to kick start your wireless project. It is powered by a strong STM32F4 microcontroller to support all kinds of applications what gives the developer high flexibility for possible applications. The board can be controlled via GUI, this software is easy to use and offers a fast way to find the right RF settings for a specific device. The second way of controlling the DP1211 Module is changing and debugging the firmware

SUPPORTED MODULES

The DPS1211 is a low cost transceiver operating in the frequency ranges from 863-870, 902- 928 MHz and 950-960 MHz. The DPS1211 is optimized for very low power consumption (3mA in receive mode) and has a very small form factor. It incorporates a baseband modem with data rates up to 200 kb/s. Data handling features include a sixty-four byte FIFO, packet handling, automatic CRC generation and data whitening. All major RF communication parameters are programmable and most of them may be dynamically set. It complies with European (ETSI EN 300-220 V2.1.1) and North American (FCC part 15) regulatory standards.

Packing List

- 2x EM1200 Board
- 2x EM1211 Board
- 2x Antennas
- 2x USB cable
- 1x CDROM with the installation files and the user guide

DEVICE OPTIONS

Part	Frequency band
SK1211C868	868 - 870 MHz
SK1211C915	902 - 928 MHz

RECOMMENDED READING

- Datasheet for DPS1211
- Datasheet for Semtech SX1211

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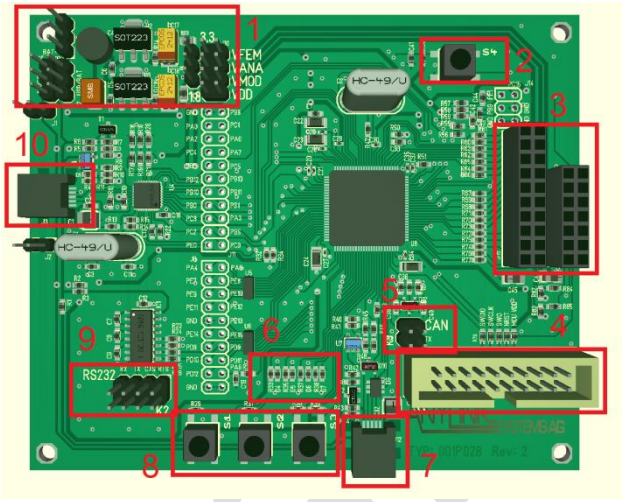
1 EVALUATION BOARD OVERVIEW

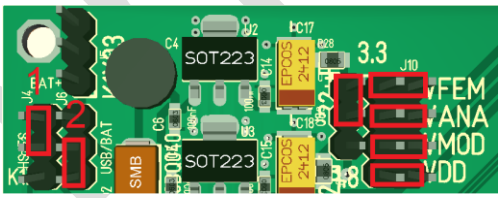
1: Power Supply
2: Reset
3: RF-Module
4: MCU debugger/programmer (ST-LINK/V2)
5: CAN (software not implemented)
6: LED indicator
7: USB / Full Speed
8: GPIO Buttons
9: RS232 (software not implemented)
10: Power via USB (only for power)



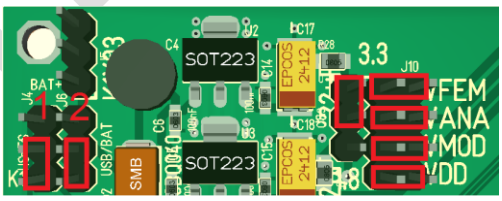
1.1 Power supply options

Configure the jumper as the red marks show it.

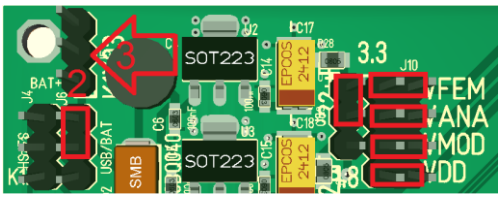
- USB/ FS (7)



- Separate USB only for power (10)



- Extern 5 – 12 V



The three pin header on the left side enable the user to setup the wanted power supply configuration. The pin header with the marking FS/HS decides if USB /FS (7) or power via USB (10) is used. If the Jumper (1) is plugged on the upper to pins Power is supplied from USB/FS (7) and if plugged on the lower pins power via USB (10) is used.
For an external power supply the upper three pin header (3) has to be used marked with the red arrow. The marking BAT+ show the pin for positive power and the other two are grounded and can be used for the negative power supply. If this option is selected the three pin header (2) below has to be fitted with a jumper in the upper position. The marking on this pin header show USB / BAT for the two USB options or the external power supply.

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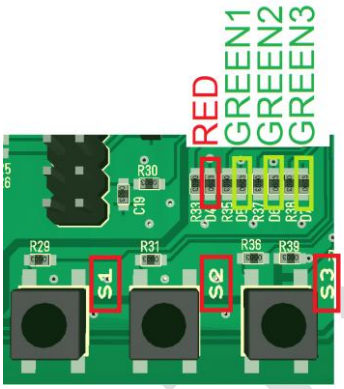
1.2 Button and LED description

The evaluation board EM1200 has several buttons to interact with the firmware running on it.

Button S1: The button saves the current running register setting for the RF chip to the MCU flash memory. If the board is reset by power off or pressing the reset button the MCU load the register setting from the flash memory.

Button S2: This button is switching manually between master and slave modes see stand alone mode (Chapter 2.) for more details.

Button S3: Initialization of a default register setting for the RF Chip in the GUI this function is called recommended settings.



Furthermore the board has four LEDs to indicate RF processing and present USB connection.

LED RED: RF missed packet
LED GREEN1: RF data packet transmit
LED GREEN2: RF data packet received
LED GREEN3: USB is active

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1.3 RF-Module Connector

The RF-Module connector is the interface to the RF-Modul. The Modul is held by an adaptor PCB that fit into the connector socket. For detailed information about the pinout have a look at the Tables below.

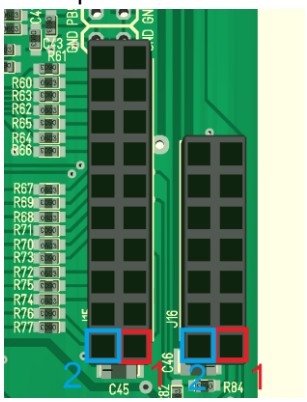

Table of 20 Pin Socket:

Pin no.:	MCU GPIO	DP1211	Description
1	PC10	SCK	SPI clock
2	-	VDD	power supply VDD_MOD
3	PC12	MOSI	SPI master out slave in
4	-	GND	power supply GND
5	PD3	IRQ1	Interrupt output 1(same as pin15)
6	PD2	PLL_LOCK	Indicates PLL lock
7	PA15	NSS_CONFIG	SPI configuration chip select
8	PC11	MISO	SPI master in slave out
9	PD5	CLKOUT	Clock output from Modul
10	PD4	NC	not connected
11	PD7	NC	not connected
12	PD6	IRQ0	Interrupt output 0
13	PE2	NC	not connected
14	PB4	NC	not connected
15	PE4	IRQ1	Interrupt output 1(same as pin 5)
16	PE3	NC	not connected
17	PE6	DATA	Data output or input in continues mode
18	PE5	NC	not connected
19	PC14	NSS_DATA	SPI data chip select
20	PC13	NC	not connected

For the DP1211 Module just the 20 Pin socket is used for communication. The 14 Pin Socket is for further Modules and possible updates.

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Table of 14 Pin Socket:

Pin no.:	MCU GPIO	DP1211	Description
1	PB7	NC	I2C SDA (optional)
2	-	NC	power supply VDD_ANA
3	PB6	NC	I2C SCL (optional)
4	-	NC	power supply GND
5	-	NC	not connected
6	-	NC	not connected
7	-	NC	not connected
8	-	NC	not connected
9	-	NC	not connected
10	-	NC	not connected
11	-	NC	not connected
12	-	NC	power supply GND
13	-	NC	not connected
14	-	NC	power supply VDD_FEM

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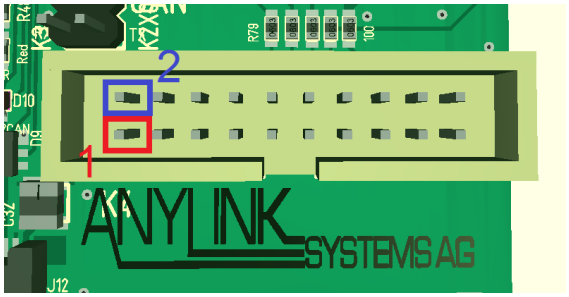
1.4 MCU debugger/programmer

The debugger/programmer connector is the standard shipped with the ST-Link/v2. It allows the user to reprogram the microcontroller with its own custom firmware and also test the firmware that comes with the EM1200. The microcontroller code is open and can be flashed from a free IDE (COOCOX CoIDE) that is easy to install and run.



Pin no.:	ST-LINK/V2	EM1200
1	VAPP	VDD
2	VAPP	NC
3	TRST	GND
4	GND	GND
5	TDI	GND
6	GND	GND
7	TMS_SWDIO	SWDIO
8	GND	GND
9	TCK_SWCLK	SWCLK
10	GND	GND
11	NC	NC
12	GND	GND
13	TDO_SWO	SWO
14	GND	GND
15	NRST	NRST
16	GND	GND
17	NC	NC
18	GND	GND
19	VDD	NC
20	GND	GND

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2 GETTING STARTED

2.1 STANDALONE MODE

The stand alone mode is applied if power supply is connected and no USB connection is present. USB connection is indicated by the flashing led GREEN3 “no Flashing = no Data transfer”.
In the Stand alone mode the device is programmed to work as ***Master*** device and transmitting data packets with a **PING** signature but also set itself in receive mode between the transmitting. If another ***Master*** device is present transmitting **PING** messages the first device to receive a **PING** switch in ***Slave*** mode Transmitting **PONG** messages. Switching between ***Master*** and ***Slave*** mode can also be done by pressing the s2 button. If a ***Master*** and ***Salve*** configuration is present the ***Master*** sends **PING** to ***Slave*** and is answered with **PONG**. As long as the ***Master*** is getting no **PONG** massage the RED LED is flashing. The LED GREEN1 show transmit and GREEN2 show receiving.
Pressing button S1 will save the current RF setting on the EM1200 device. This setting is applied at every reset and power on reset. Even a long power off - power on is not deleting the saved settings. Just a new saving event can overwrite the old settings, because they are saved in the microcontroller flash memory.
Pressing button S3 sets all RF setting to the software defined defaults equal to the GUI function *Recommended Settings*

2.2 SAVING SETTINGS ON THE STARTERKIT

Having the ability to save different register settings on the Starter kit, can be a very helpful tool for every Developer. That for the EM1200 Start kit is able to save four different register setting for the RF Chip. This Setting can be accessed via the buttons during the startup procedure after every Reset event.

2.2.1 Save Register Setting on the Starterkit

Start with creating a setting with the graphical user interface. If the GUI shows the right settings there is two ways how to save this setting.
One is to use the “Save on device” function in the “Configuration” menu. Simply press it and watch the RED LED light up for a second. Now you saved the setting in position one to use a differed position press S3 while the RED LED is on and it jumps to GREEN1, GREEN2 and GREEN3. Every LED stands for a different save position. Saving at the same position twice overnights the old register setting.
Second way to save is to press the Save button S1, the RED LED will also light up for a second with mean you saved at first position. Keeping the button S1 pressed and shortly pressing button S3 and you change the save position.

2.2.2 Load Register Setting on the Starterkit

Loading the saved Register setting is done automatically in the reset procedure. Save position one (RED LED) is default and can be changed by pressing button S3 while the RED LED is on. The other LEDs will light up one after another, if you reached the required position just let it finish start up and you done.

2.3 SOFTWARE INSTALLATION

2.3.1 EM1200 USER INTERFACE

Windows 7 software installation.
The installation media also contains also the **Microsoft Visual Studio 2005 C Runtime** that must be installed on the target computer. Installation can be started by running “**vcdredist_x86/vcdredist_x86.exe**” on the installation media.
To install the **User Interface** starting the “**EM1200 Software.msi”** that can be found on the installation media.

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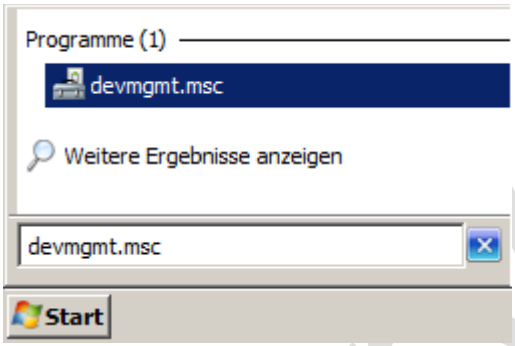
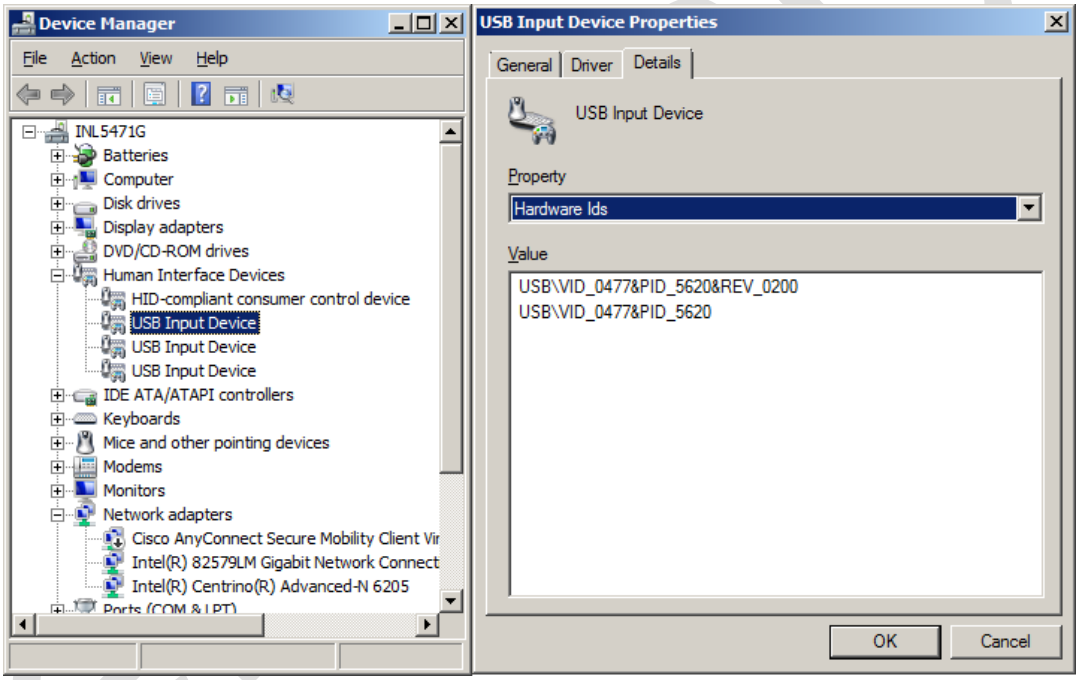
2.3.2 EM1200 DRIVER SETUP

The driver can only be installed while the EM1200 is connected.

The driver must be installed using the device manager. The device manager can be started from the Windows Start menu by running the command "**devmgmt.msc**"



The EM1200 Board identifies itself as USB Input device. The EM1200 can be identified with the following Hardware ID's.



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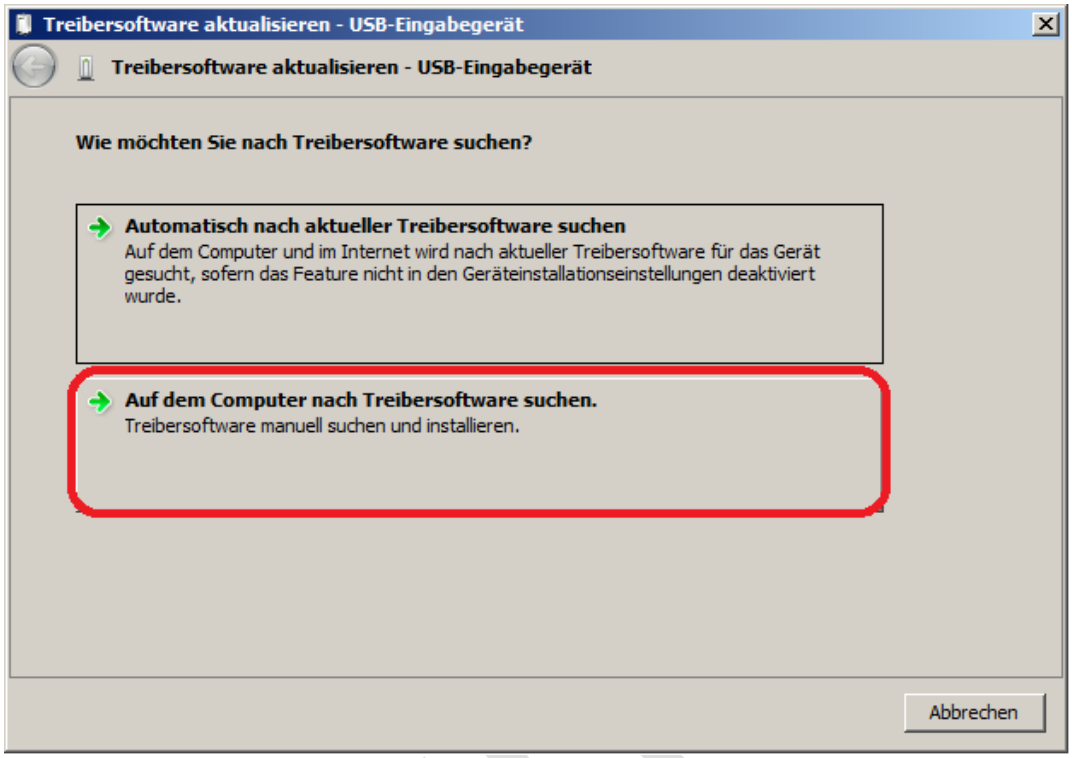
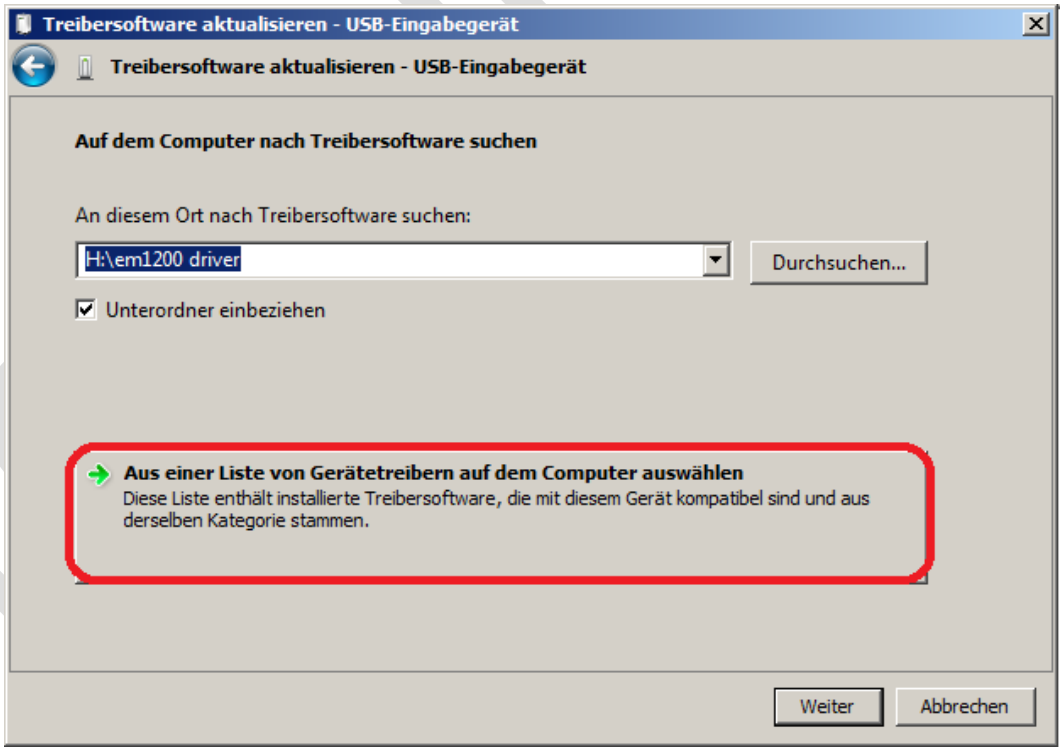
Select “**Brows computer for driver software**”

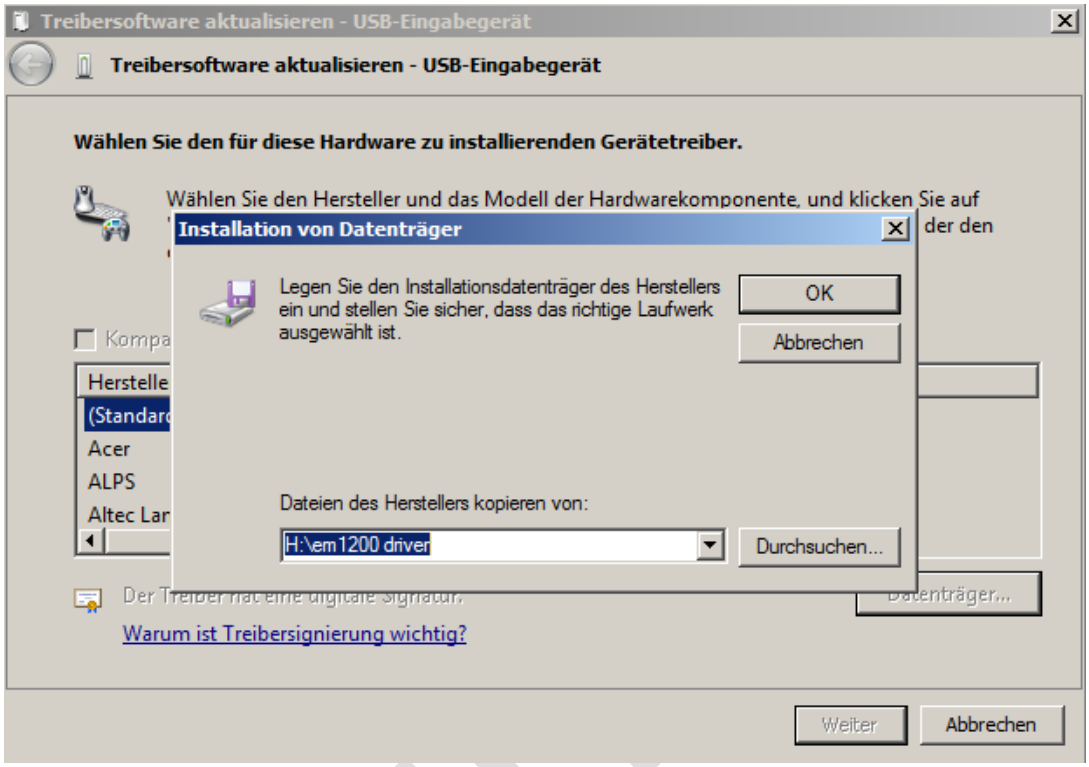

Treibersoftware aktualisieren - USB-Eingabegerät
Treibersoftware aktualisieren - USB-Eingabegerät
Wie möchten Sie nach Treibersoftware suchen?
Automatisch nach aktueller Treibersoftware suchen
Auf dem Computer und im Internet wird nach aktueller Treibersoftware für das Gerät gesucht, sofern das Feature nicht in den Geräteinstallationseinstellungen deaktiviert wurde.
Auf dem Computer nach Treibersoftware suchen.
Treibersoftware manuell suchen und installieren.
Abbrechen

Select “**Let me pick from a list of device drivers on my computer**”

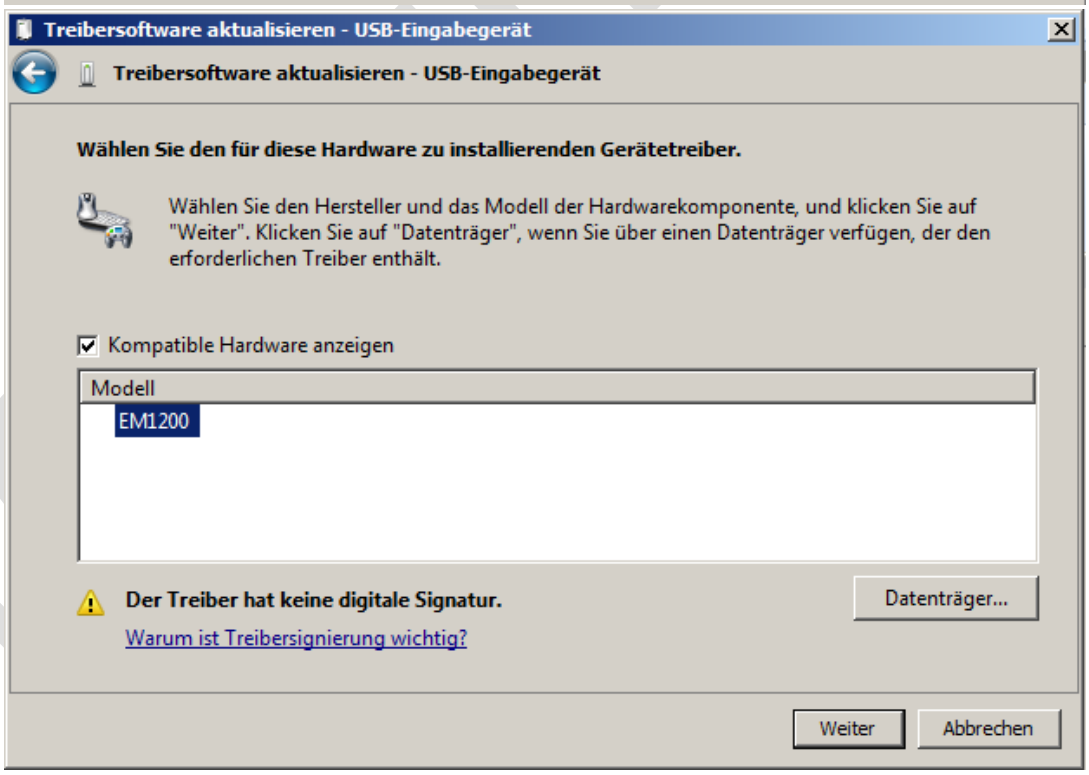

Treibersoftware aktualisieren - USB-Eingabegerät
Treibersoftware aktualisieren - USB-Eingabegerät
Auf dem Computer nach Treibersoftware suchen
An diesem Ort nach Treibersoftware suchen:
H:\em1200 driver
Durchsuchen...
Unterordner einbeziehen
Aus einer Liste von Gerätetreibern auf dem Computer auswählen
Diese Liste enthält installierte Treibersoftware, die mit diesem Gerät kompatibel sind und aus derselben Kategorie stammen.
Weiter
Abbrechen

Click on the “**Hard disk**” Button and brows to the EM1200 driver directory.

After installation of the User Interface the Driver for the USB Device can be found in the Installation Folder. With the default installation Path the driver can be found in.
“%PROGRAMFILES%\ANYLINK Systems\EM1200 Software\EM1200 driver”

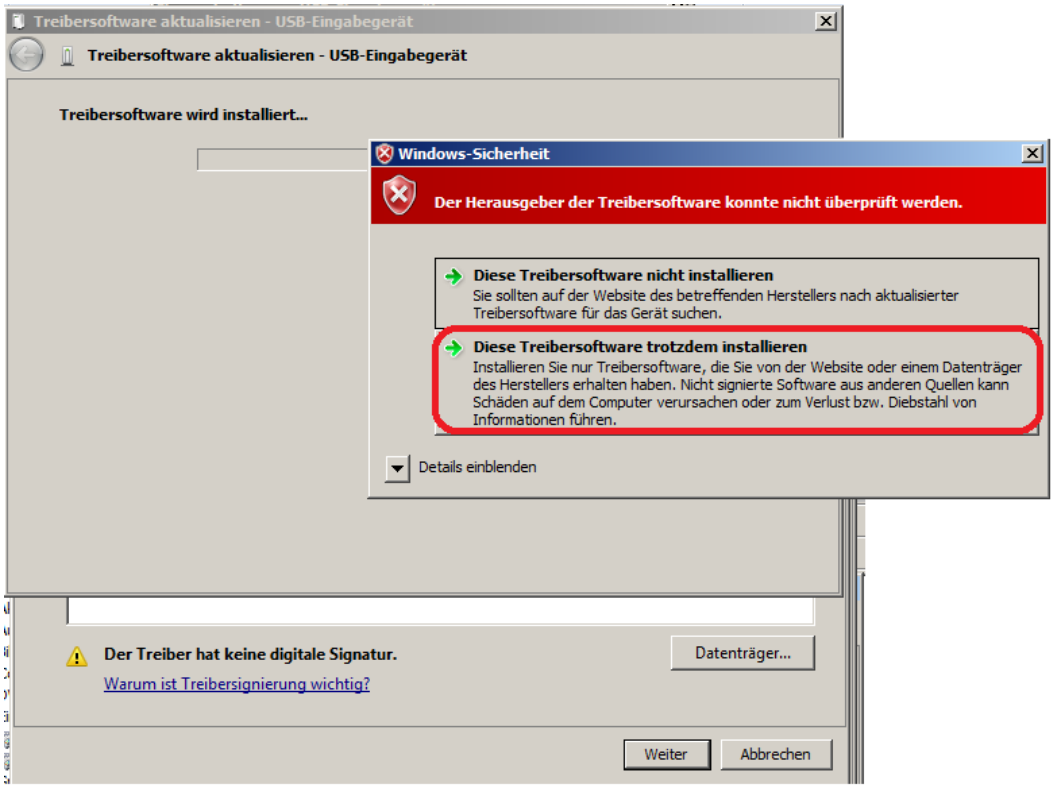


Select the EM1200 driver and click "**Continue**"

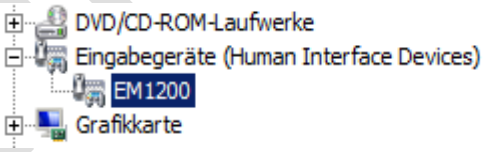

Treibersoftware aktualisieren - USB-Eingabegerät
Treibersoftware aktualisieren - USB-Eingabegerät
Wählen Sie den für diese Hardware zu installierenden Gerätetreiber.
Wählen Sie den Hersteller und das Modell der Hardwarekomponente, und klicken Sie auf "Weiter". Klicken Sie auf "Datenträger", wenn Sie über einen Datenträger verfügen, der den erforderlichen Treiber enthält.
Kompatible Hardware anzeigen
Modell
EM1200
Der Treiber hat keine digitale Signatur.
Warum ist Treibersignierung wichtig?
Datenträger...
Weiter
Abbrechen

pro

As the driver is unsigned, you will receive a warning during driver installation. To continue the driver installation click "**Install this driver anyway**".


Treibersoftware aktualisieren - USB-Eingabegerät
Treibersoftware aktualisieren - USB-Eingabegerät
Treibersoftware wird installiert...
Windows-Sicherheit
Der Herausgeber der Treibersoftware konnte nicht überprüft werden.
Diese Treibersoftware nicht installieren
Sie sollten auf der Website des betreffenden Herstellers nach aktualisierter Treibersoftware für das Gerät suchen.
Diese Treibersoftware trotzdem installieren
Installieren Sie nur Treibersoftware, die Sie von der Website oder einem Datenträger des Herstellers erhalten haben. Nicht signierte Software aus anderen Quellen kann Schäden auf dem Computer verursachen oder zum Verlust bzw. Diebstahl von Informationen führen.
Details einblenden
Der Treiber hat keine digitale Signatur.
Warum ist Treibersignierung wichtig?
Datenträger...
Weiter
Abbrechen

After successful installation of the driver, the device should show up in the Device Manager as EM1200.



2.3.3 SAMPLE CONFIGURATIONS

You can find sample configurations for different applications of the modules in the installation directory and on the installation media.

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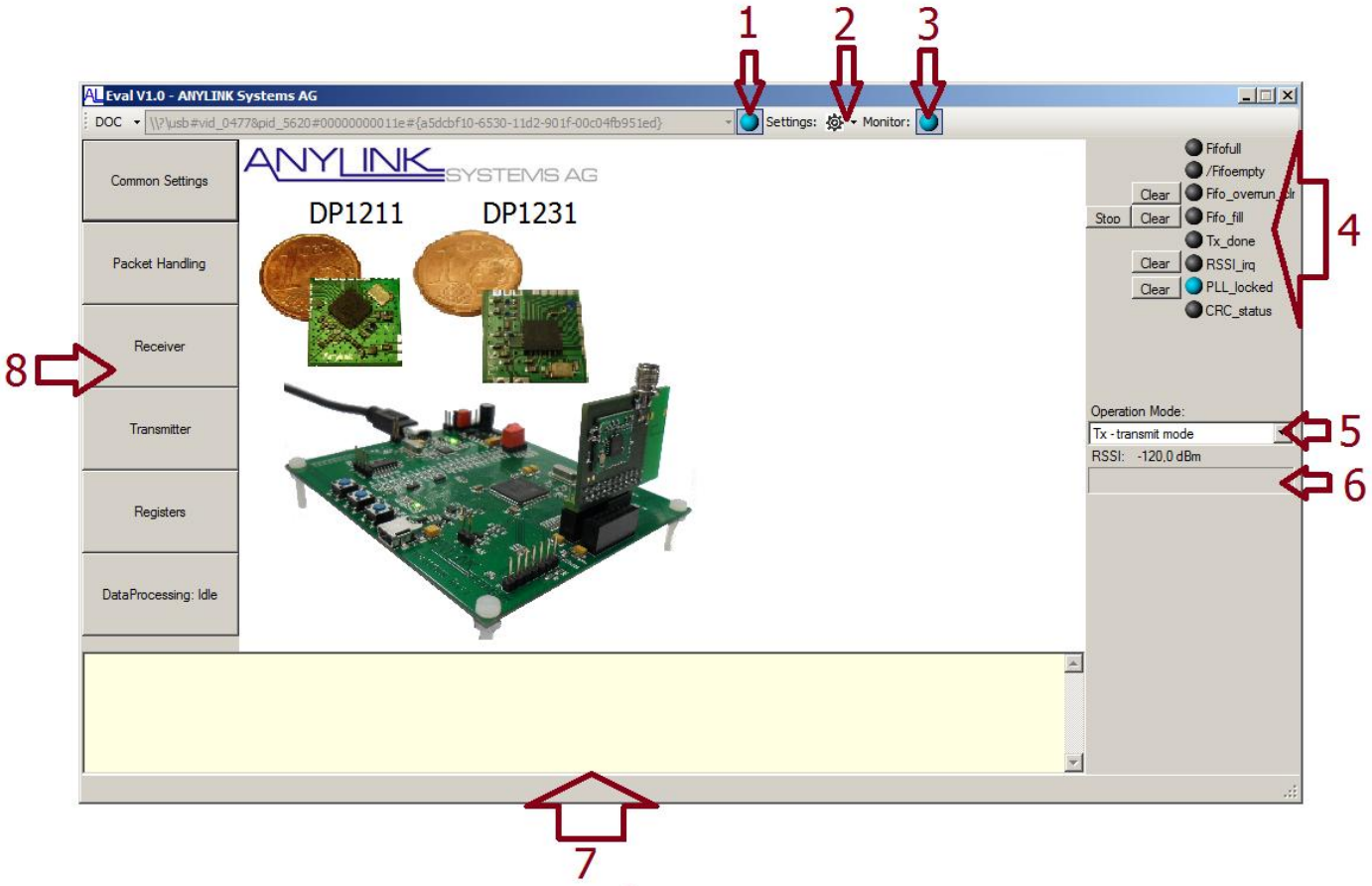
3 DPS1211 USER INTERFACE DESCRIPTION

3.1 OVERVIEW



1. Connect Button – Press to connect or disconnect the EM1200 Board
2. Settings Menu
3. Button to enable/disable register monitoring
4. Current interrupt states of the module if register monitoring is enabled
5. Current operation mode of the module if register monitoring is enabled
6. Current input RSSI Value
7. Description of Parameters for the selected configuration parameter
8. Settings section selection – while the module is disconnected settings cannot be modified.

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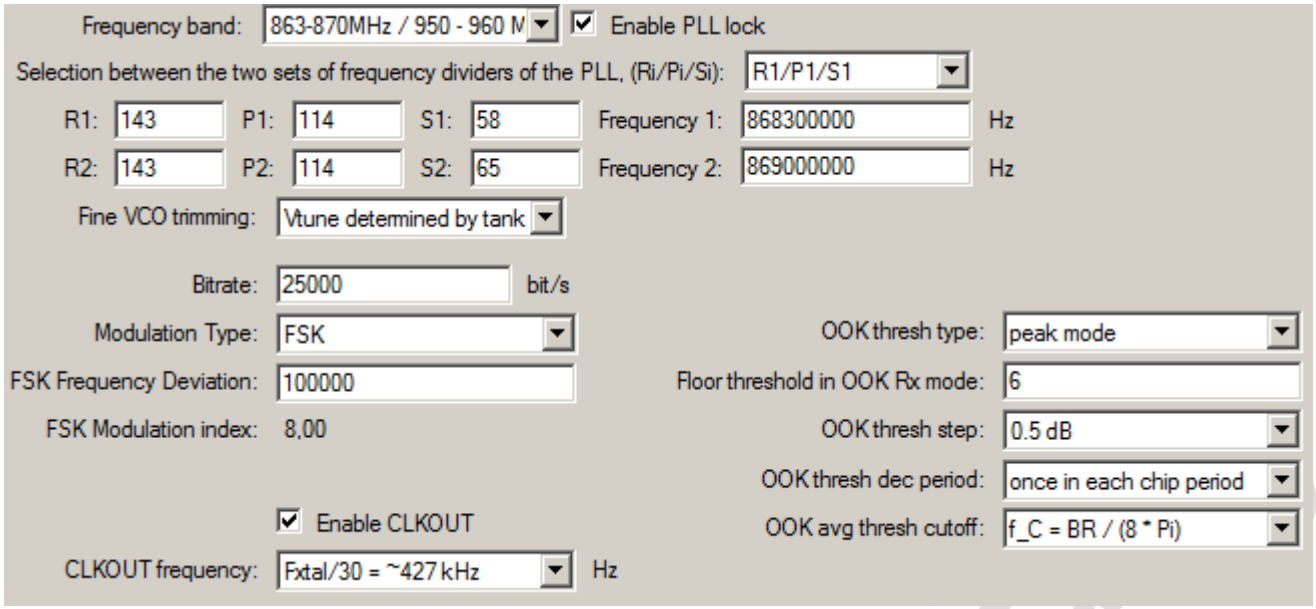
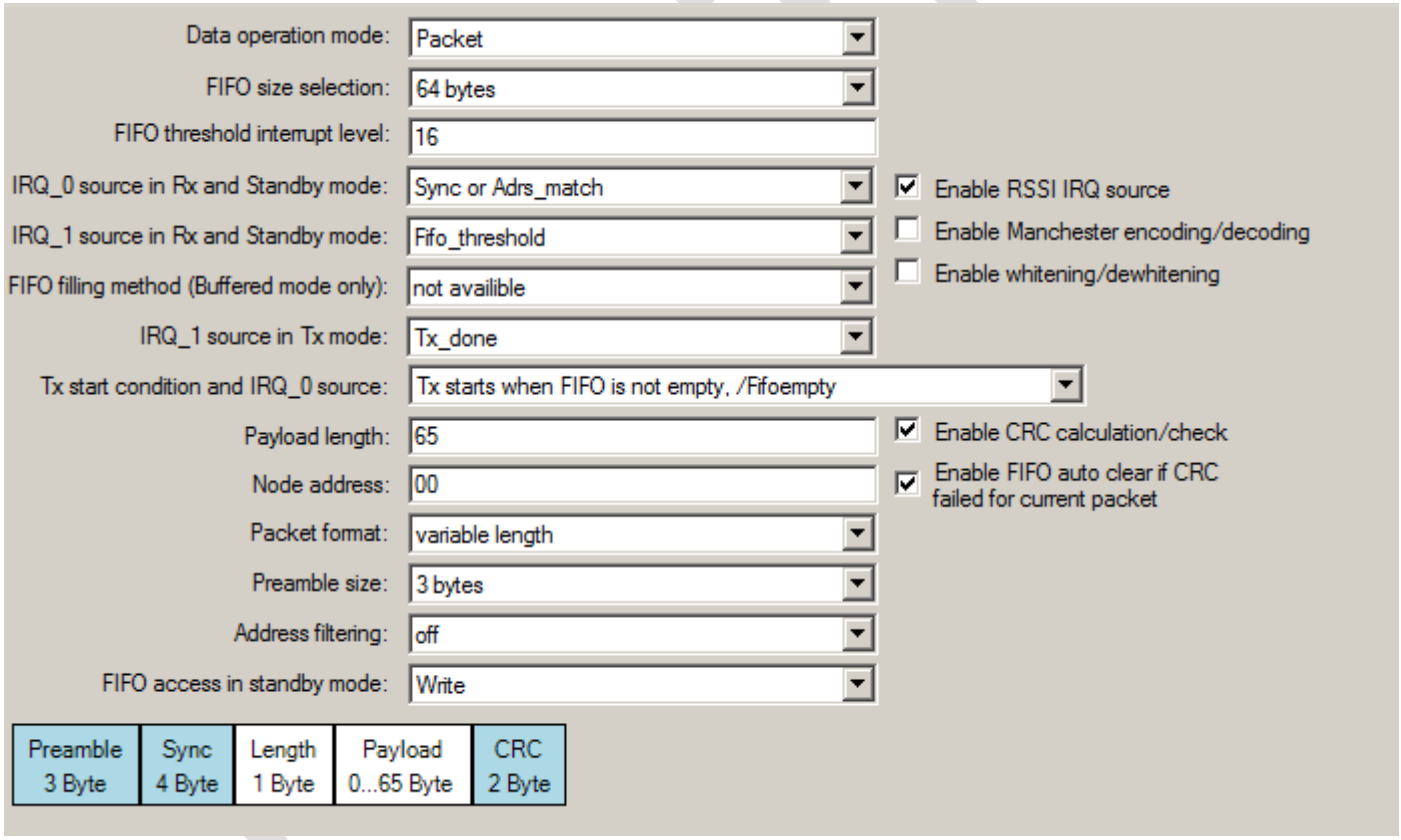
3.2 COMMON


Frequency band: 863-870MHz / 950 - 960 M
Enable PLL lock
Selection between the two sets of frequency dividers of the PLL, (Ri/Pi/Si): R1/P1/S1
R1: 143 P1: 114 S1: 58 Frequency 1: 868300000 Hz
R2: 143 P2: 114 S2: 65 Frequency 2: 869000000 Hz
Fine VCO trimming: Vtune determined by tank
Bitrate: 25000 bit/s
Modulation Type: FSK
FSK Frequency Deviation: 100000
FSK Modulation index: 8,00
OOK thresh type: peak mode
Floor threshold in OOK Rx mode: 6
OOK thresh step: 0.5 dB
OOK thresh dec period: once in each chip period
OOK avg thresh cutoff: f_C = BR / (8 * Pi)
Enable CLKOUT
CLKOUT frequency: Fxtal/30 = ~427 kHz
Hz

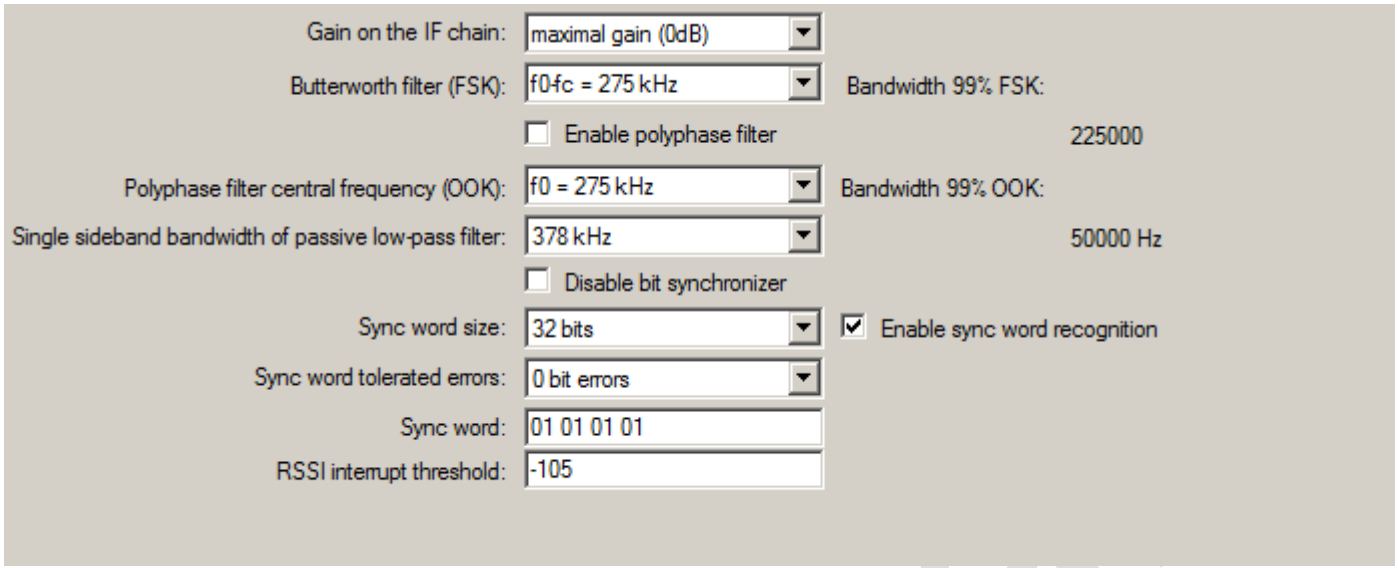
This Configuration Section gives access to the working frequency and the modulation parameters of the module.

3.3 PACKET HANDLING


Data operation mode: Packet
FIFO size selection: 64 bytes
FIFO threshold interrupt level: 16
IRQ_0 source in Rx and Standby mode: Sync or Adrs_match
Enable RSSI IRQ source
IRQ_1 source in Rx and Standby mode: Fifo_threshold
Enable Manchester encoding/decoding
FIFO filling method (Buffered mode only): not availible
Enable whitening/dewhitening
IRQ_1 source in Tx mode: Tx_done
Tx start condition and IRQ_0 source: Tx starts when FIFO is not empty, /Fifoempty
Payload length: 65
Enable CRC calculation/check
Node address: 00
Enable FIFO auto clear if CRC failed for current packet
Packet format: variable length
Preamble size: 3 bytes
Address filtering: off
FIFO access in standby mode: Write
Preamble 3 Byte
Sync 4 Byte
Length 1 Byte
Payload 0...65 Byte
CRC 2 Byte

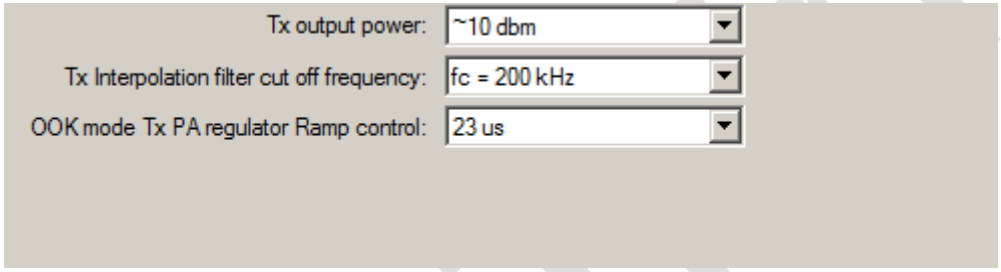
This Section allows configuration of the Packet format in Packet mode, Buffered Mode is also supported by the µC Firmware with a limit of 255 bytes of payload. Continuous mode is not supported by the µC Firmware.

3.4 RECEIVER



This Section gives access to the configuration parameters for the Receiver and Digital Data Detection mechanisms.

3.5 TRANSMITTER



This Section allows configuration of the Transmitter.

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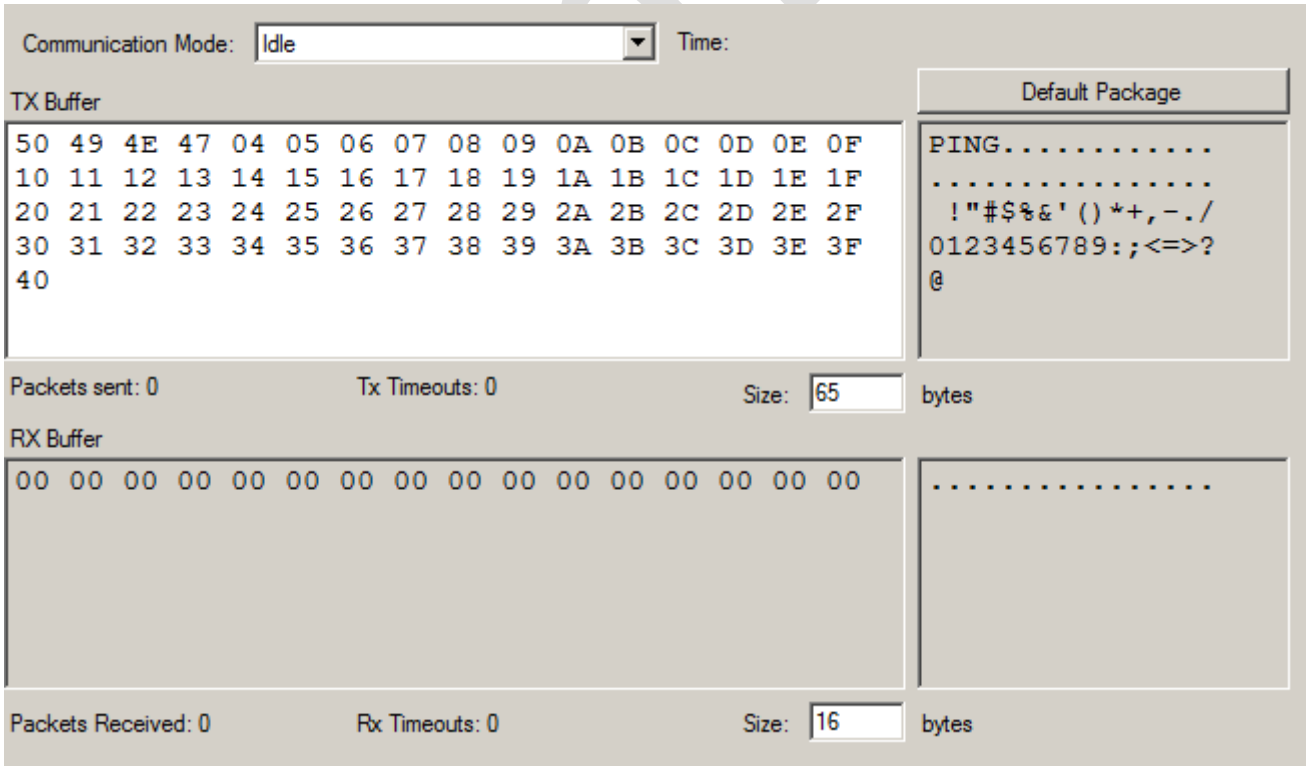
3.6 REGISTERS

Addr	Value	Addr	Value
0x00	10	0x10	A3
0x01	8C	0x11	38
0x02	03	0x12	38
0x03	07	0x13	07
0x04	0C	0x14	00
0x05	D0	0x15	00
0x06	8F	0x16	01
0x07	72	0x17	01
0x08	3A	0x18	01
0x09	8F	0x19	01
0x0A	72	0x1A	72
0x0B	41	0x1B	BC
0x0C	38	0x1C	40
0x0D	F8	0x1D	00
0x0E	19	0x1E	C8
0x0F	1E	0x1F	00

This section gives direct Access to the register values of the SX1211.

3.7 DATA PROCESSING



This section allows transmission and reception of Data with the current configuration of the SX1211.

Preliminary

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Version	Create Date:	Creator	Changes
01 preliminary	03.11.14		Create new Datasheet
02 preliminary	18.12.14		Update new Details

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